MATERIAL SAFETY DATA SHEET

SRM Supplier: National Institute of Standards and Technology
Standard Reference Materials Program
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Gaithersburg, Maryland 20899-2321

SRM Number: 2637a
MSDS Number: 2637a
SRM Name: Carbon Monoxide in Nitrogen
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SECTION I. MATERIAL IDENTIFICATION

Material Name: Carbon Monoxide in Nitrogen

Description: This SRM mixture is supplied in a DOT 3AL specification aluminum (6061 alloy) cylinder with a water volume of 6 L. Mixtures are shipped with a nominal pressure exceeding 12.4 MPa (1800 psi) which provides the user with 0.73 m^3 (25.8 ft^3) of useable mixture. The cylinder is the property of the purchaser and is equipped with a CGA-350 brass valve, which is the recommended outlet for this carbon monoxide mixture. NIST recommends that this cylinder not be used below 0.7 MPa (100 psi).

Other Designations: Carbon Monoxide (carbon oxide) in **Nitrogen** (dinitrogen) **Gas Cylinder**

Chemical Name	Chemical Formula	CAS Registry Number
Carbon Monoxide	CO	630-08-0
Nitrogen	N_2	7727-37-9

DOT Classification: Non-flammable Gas, UN1956

Manufacturer/Supplier: Available from a number of suppliers

SECTION II. HAZARDOUS INGREDIENTS

Hazardous Components	Nominal Concentration	Exposure Limits and Toxicity Data
Carbon Monoxide	2500 μmol/mol	ACGIH TWA: 25 mg/kg
		OSHA TWA: 50 mg/kg or 55 mg/m^3
		Rat, Inhalation: LC_{50}: 1807 mg/m^3/4 h
		Mouse, Inhalation: LC_{50}: 2444 mg/kg/4 h
		Human, Inhalation: LC_{LO}: 4 mg/m^3/12 h
		Human, Inhalation: TC_{LO}: 600 mg/m^3/10 min
		Human, Inhalation: LC_{LO}: 4000 mg/kg/30 min
Nitrogen	balance	simple asphyxiant
		Rat, Inhalation: LC_{50}: 1068 mg/m^3/4 h
		Mouse, Inhalation: LC_{LO}: 320 mg/kg

SECTION III. PHYSICAL/CHEMICAL CHARACTERISTICS

Nitrogen	Carbon Monoxide
Appearance and Odor: colorless and odorless	**Appearance and Odor:** colorless and odorless
Relative Molecular Mass: 28.0134	**Relative Molecular Mass:** 28.01
Density: 1.2506 g/L	**Density:** 1.250 g/L
Vapor Density (air = 1): 0.967	**Vapor Density (air = 1):** 0.968
Vapor Pressure (-196 °C): 760 mm Hg	**Vapor Pressure (-191 °C):** 760 mm Hg
Freezing Point: -210 °C	**Freezing Point:** -199 °C
Boiling Point: -196 °C	**Boiling Point:** -192 °C
Viscosity (@ 27 °C): 0.01787 cP	**Viscosity (@ 27 °C):** 0.01657 cP
Water Solubility: 1.6 %	**Water Solubility**: 2.3 %
Solvent Solubility: soluble in liquid ammonia; slightly soluble in alcohol	**Solvent Solubility:** soluble in alcohol, benzene, acetic acid, ethyl acetate, chloroform, cuprous chloride solutions

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

Carbon Monoxide
Flash Point: Not Available **Autoignition Temperature:** 609 °C

Flammability Limits in Air (Volume %): **UPPER:** 74
LOWER: 12.5

Unusual Fire and Explosion Hazards: Cylinders may rupture under fire conditions. Nitrogen reacts with lithium, magnesium, neodymium at high temperatures. Mixtures of ozone and nitrogen may be explosive. Titanium is the only element that will burn in nitrogen.

Carbon monoxide is a severe fire hazard. Vapor/air mixtures are explosive. Vapors or gasses may ignite at distant ignition sources and flash back.

Extinguishing Media: Use extinguishing media that is appropriate to the surrounding fire.

Special Fire Procedures: Fire fighters should wear full protective clothing and self-contained breathing apparatus (SCBA) when this material is involved in a fire. Keep fire cylinders cool with water spray. If possible, stop the product flow.

SECTION V. REACTIVITY DATA

Stability: **X** **Stable** ____ **Unstable**

Conditions to Avoid: Protect cylinders from physical damage and sources of heat. **DO NOT** store in poorly ventilated areas.

Incompatibility (Materials to Avoid): Carbon monoxide is incompatible with oxidizing materials, halogens, metal oxides, metals, combustible materials, and lithium. Nitrogen is incompatible with metals and oxidizing materials.

See Section IV: *Fire and Explosion Hazard Data*

Hazardous Decomposition or Byproducts: Thermal decomposition of nitrogen will produce oxides of nitrogen. Thermal decomposition of carbon monoxide will produce oxides of carbon.

Hazardous Polymerization: _____ **Will Occur** **X** **Will Not Occur**

SECTION VI. HEALTH HAZARD DATA

Route of Entry: **X** **Inhalation** **X** **Skin** _____ **Ingestion**

Nitrogen: This material is a high pressure gas that can cause rapid suffocation. This gas may also cause eye, skin, and respiratory tract burns. The mixture can act as a simple asphyxiant by displacing air necessary for life. Nitrogen inhaled under increased atmospheric pressure, (>1.5 atmospheres), may dissolve in the fat-containing brain cells, and act as an anesthetic, causing necrosis. Persons who have been exposed to nitrogen under increased pressure and then suddenly released from the pressure may develop decompression sickness. Decompression is sickness caused by the formation of nitrogen bubbles in the blood following a rapid drop in pressure and is characterized by severe pains in the joints and chest, skin irritation, cramps, and paralysis.

Carbon Monoxide: Carbon monoxide is not detectable by odor; a headache should be taken as a warning that a dangerous concentration level is being inhaled. In exposures to high concentrations, weakness and dizziness may be the only symptoms preceding collapse. Carbon monoxide replaces hemoglobin in the blood forming carboxyhemoglobin. The amount of carboxyhemoglobin formed in the blood is dependent on the concentration and duration of exposure, ambient temperature, physical exertion, and individual metabolism. Symptoms are usually not noticeable until carboxyhemoglobin levels reach 10 %. At this level, symptoms may include severe headache, dyspnea, decreased manual dexterity, emotional instability, dizziness, fatigue, drowsiness, confusion, nausea, vomiting, and impaired vision and hearing. Alcohol and tobacco may enhance the toxic effects.

Although carbon monoxide is not a cumulative poison, chronic exposure to low or moderate levels may result in repeated bouts of oxygen deprivation and result in effects including cardiovascular or central nervous system damage. Carbon monoxide may cross the placenta.

Medical Conditions Generally Aggravated by Exposure: Nitrogen: respiratory disorders

Carbon Monoxide: blood system disorders, heart or cardiovascular disorders, hormonal disorders, and respiratory disorders

Listed as a Carcinogen/Potential Carcinogen:

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens		X
In the International Agency for Research on Cancer (IARC) Monographs		X
By the Occupational Safety and Health Administration (OSHA)		X

EMERGENCY AND FIRST AID PROCEDURES:

Skin Contact: Remove contaminated shoes and clothing. Rinse affected area with copious amounts of water for at least 15 minutes while removing contaminated clothing. Obtain medical assistance if necessary.

Eye Contact: Immediately flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Obtain medical assistance if necessary.

Inhalation: Immediately remove victim to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. Lay victim with head and chest lower than hips to improve drainage of fluids from the lungs. Obtain medical assistance.

Ingestion: Not Applicable

TARGET ORGAN(S) OF ATTACK: **Carbon Monoxide:** blood

SECTION VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken in Case Material is Released: Evacuate and ventilate area. Remove leaking cylinder to exhaust hood or safe outdoor area. Shut off source if possible and remove source of heat. In case of leakage, use SCBA.

Waste Disposal: Dispose of gas into an adequate amount of alkaline potassium permanganate solution. Dispose of non-refillable cylinders in accordance with federal, state, and local regulations. **DO NOT** return the empty cylinder to the supplier.

Handling and Storage: Secure cylinder when using to protect from falling. Use suitable hand truck to move cylinders. Wear safety shoes when handling cylinders. Use adequate general and local exhaust ventilation to maintain concentrations below exposure limits and to avoid asphyxiation. A chemical safety shower and an eyewash station must be readily available. For protection of eyes, wear safety glasses.

> **NOTE:** Contact lenses pose a special problem; soft lenses may absorb irritants and all lenses concentrate them. **DO NOT** wear contact lenses in the laboratory.

Store in well ventilated areas away from combustibles. Keep valve protection cap on cylinders when not in use.

SECTION VIII. SOURCE DATA/OTHER COMMENTS

Source: MDL Information Systems, Inc., MSDS *Nitrogen,* 17 June 2002.
MDL Information Systems, Inc., MSDS *Carbon Monoxide,* 17 June 2002.